

# **Department of Defense**

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## **Verification, Validation and Accreditation (VV&A) Recommended Practices Guide**

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Office of the Director  
of Defense Research and Engineering  
Defense Modeling and Simulation Office



MEMORANDUM FOR: GENERAL DISTRIBUTION

SUBJECT: Verification, Validation, and Accreditation (VV&A)  
Recommended Practices Guide

I commend to you the attached guide which provides background and information on principles, processes, and techniques which are recommended for use in DoD VV&A efforts which support program initiatives in the analysis, acquisition, and training communities.

These guidelines reflect a year-long study of Service directives and VV&A techniques from government, industry and academia. An integrated team of DoD-recognized VV&A experts authored the Guide and obtained informal coordination throughout its development from contributors across DoD.

The guide will continue development during Fiscal Year 1997 to include more detailed guidance for VV&A efforts performed to support modeling and simulation in the three functional areas of analysis, acquisition, and training.

Please call Mrs. Priscilla Glasow, DMSO Technical Support Staff, at 703-824-3412, or complete the evaluation form at the back of this document if you have any questions or suggestions for improvement.

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*V&V Recommended Practices Guide* Evaluation Form

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## Acronym List

AAR	after action review
ALSP	Aggregate-Level Simulation Protocol
ANSI/IEEE	American National Standards Institute/Institute of Electrical and Electronics Engineers
AR	Army Regulation
CDR	Critical Design Reviews
c.i.	confidence interval
CINCs	Commanders in Chief
C/M	Configuration Management
CMMS	Conceptual Models of the Mission Space
CPU	central processing unit
DARPA	Defense Advance Research Projects Agency
DIS	Distributed Interactive Simulation
DLA	Defense Logistics Agency
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDDI	Department of Defense Directives and Instructions
DoDI	Department of Defense Instruction
ECM	electronic countermeasures
EMF	exercise management and feedback
FOMs	Federation Object Models
FRED	Federation Required Execution Details
HLA	High-Level Architecture
IAC	Information Analysis Center
IPR	In-Process Reviews
IST	Institute for Simulation Training
IV&V	Independent Verification and Validation
JTC	Joint Training Confederation
M&S	Modeling and Simulation
MOEs	Measures of Effectiveness

MOMs	Measures of Merit (MOMs encompass MOEs, MOOs, and MOPs)
MOOs	Measures of Outcome
MOPs	Measures of Performance
MORS	Military Operations Research Society
m.r.a.	model range of accuracy
MSRR	Modeling and Simulation Resource Repository
PDR	Preliminary Design Reviews
PDU	Protocol Data Units
ROI	return on investment
RTI	Run Time Infrastructure
s.c.i.	simultaneous confidence intervals
SEI	Software Engineering Institute
SIMNET	Simulator Networking
SMART	Susceptibility Model Assessment with Range Test
SME	subject matter experts
SOMs	Simulation Object Models
STRICOM	Simulation, Training, and Instrumentation Command
T&E	test and evaluation
UJTL	Uniform Joint Task List
V&V	Verification and Validation
VV&A	Verification, Validation, and Accreditation
VV&C	Verification, Validation, and Certification

## Meet the Authors

In early 1995, the Defense Modeling and Simulation Office (DMSO) formed a VV&A Technical Support Team to develop and write a guide of recommended VV&A practices for the Department of Defense. The VV&A Technical Support Team was initially formulated to include representation of early DoD experience in federating models and simulations, such as legacy models, Distributed Interactive Simulation (DIS), and new model developments. Subsequent additions to team membership ensured informal representation of the military services, academia, and industry. The Guide as written today successfully incorporates existing directives and guidelines available from all of these sources.

This section provides the reader with brief descriptions of the authors and their credentials in the VV&A community.

Mrs. Priscilla A. Glasow, the Guide's Editor, originated the concept of a Technical Support Team to author a guidelines document to meet the requirements of the DoD Modeling and Simulation Master Plan. She successfully organized and led a team of proven VV&A experts from all defense communities, providing clear management as DMSO's direct representative and herself authoring significant portions of key chapters. Mrs. Glasow is a Senior Systems Analyst with Science Applications International Corporation and serves on DMSO's Technical Support Staff.

Dr. Paul Muessig of the Susceptibility Model Assessment and Range Test (SMART) Project Office in China Lake, California, is one of the original members of the team since its inception and has provided clear leadership in the development of the Guide. He has served as both a representative of the acquisition community and the U.S. Navy. The SMART process was used as a baseline study from which the generic VV&A process and the methodology described herein were developed. The primary author of Chapter 1, Dr. Muessig also contributed significantly to the other chapters and to the discussions which guided the development of the Guide in its conceptual stage.

Similarly, the Guide reflects the invaluable wisdom and guidance of Mr. James Sikora, Senior Vice President and General Manager of BDM Management Services Company in Albuquerque, New Mexico. Mr. Sikora is well known for his co-chairmanship of the Simulation Validation series of workshops under the Military Operations Research Society (MORS). It was the initial workshop under this series that first formulated the definitions for VV&A that were later adopted by DoD and are in use today. Mr. Sikora's representation of the analytic community and his long-term close association with the U.S. Air Force's Operational Test and Evaluation Command (AFOTEC) ensured that the Guide met the requirements of these communities as well. Mr. Sikora authored Chapters 5 and 6 and provided sage overall perspective to the team in its development of the other chapters.

A third key player in the development of the Guide was Ms. Simone Youngblood of Illgen Simulation Technologies, Inc. Ms. Youngblood has served as the Chair of the VV&A sub-working group in the DIS Workshop for many years and is widely recognized as the leading author of the DIS Nine-Step VV&A Process. Serving as both a DIS community representative and that of industry, Ms. Youngblood authored Chapter 3.

Dr. Osman Balci, Associate Professor of Computer Science at Virginia Polytechnic University, is a well-known and widely respected author of numerous treatises on software verification, validation, and testing. As the team's academic representative, he provided a significantly new and different perspective and ensured much re-thinking of the team's objectives and solutions. Dr. Balci shared his extensive background in his writing of Chapters 2 and 4.

Ms. Susan Solick of the U.S. Army's TRADOC Analysis Command located at Fort Leavenworth, Kansas, and Dr. Ernie Page of MITRE Corporation were key contributors to the development of Chapter 3 and the descriptions of the DIS and Aggregate Level Simulation Protocol (ALSP) processes. Ms. Solick has worked with the DIS community for the past 3 years and served as the team's U.S. Army representative. Dr. Page is the a leading member of the VV&A Technical Staff for the ALSP Joint Training Confederation.

The contributions of earlier members of the Technical Support Team and leaders in the VV&A community are also noted. Ms. Pam Blechinger served on the Technical Support Team in its first year and was an active participant in the discussions which resulted in the initial draft of the Guide. Mr. Robert Lewis of Quality Research, Inc. of Huntsville, Alabama was a leading source of VV&A theory and is the author of a tailoring and costing study which has served as the basis for that work in this Guide. Mr. Chuck Winget of Illgen Simulation Technologies, Inc. was also a frequent contributor and provided a valuable assessment of Mr. Lewis' costing model.

## **Making the Best Use of This Document**

The Department of Defense (DoD) Verification, Validation, and Accreditation (VV&A) *Recommended Practices Guide* is written for use by all developers and users of Modeling and Simulation (M&S) in DoD. This general audience is divided into three loosely defined “groups”—decision makers, program managers, and technical staff—a distinction that merely serves to define different levels of involvement in the VV&A process.

### **The Chapters in Brief**

All readers will be interested in the Chapter 1 overview, particularly those sections dealing with the benefits of doing VV&A and tailoring it to contain costs.

Chapter 2 discusses basic principles of VV&A and provides amplification of the major points contained in Chapter 1.

Chapter 3 introduces a generic VV&A process and discusses its relationship to various types of M&S applications, including the High-Level Architecture (HLA). This chapter will be of particular interest to program managers who must integrate VV&A into their overall programs.

Chapter 4 is the technical meat of the guide, offering technical staff a host of fundamentals and techniques for performing VV&A and helping readers determine which techniques are most useful for specific types of M&S application. This section will be greatly expanded as programs mature and case studies become available.

Chapter 5 discusses the accreditation process and the work that must be done to reach a sound decision about the suitability of M&S for particular applications. It is an excellent chapter to guide the decision maker on how to plan for and implement the accreditation process and on how to integrate V&V into the decision.

Finally, Chapter 6 introduces common reporting formats for the reports that should document any VV&A effort. Although each Branch of Service may prescribe the reports it requires, this chapter provides formats that meet the common needs of all Services and thus are particularly useful when M&S is applied to a Joint requirement.

### **Recommended Reading for Specific Needs**

Chapters 1 and 5 are recommended for decision makers who need a quick overview of VV&A and information on the accreditation process.



Program managers are referred to Chapters 1, 2, 3, and 5. Again, a quick overview of what VV&A is all about is a necessary introduction. Program managers will also be interested in the principles and processes of VV&A as they incorporate these into their programs. Finally, Chapter 5 is important to assist program managers in preparing senior decision makers for the accreditation decision.

The technical staff whose job is to do the actual V&V should read the entire document. In addition to the chapters noted above, Chapter 4 will give these users valuable guidance on specific techniques that are used in V&V, and Chapter 6 will provide common reporting formats to help them document the VV&A effort.